#9 Fed 9/23

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Name of Person Faxing: Colleen J. Dew

Signature: Colleen J. Dew

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE	
In Re Application of: Ping-Chuan Wang et al.	August 19, 2003 Examiner: Ida M. Soward
Serial No. 10,026,117 Filing Date: 12/21/2001	Group Art Unit: 2822
Title: LOW DIELECTRIC CONSTANT MATERIAL REINFORCEMENT FOR IMPROVED ELECTROMIGRATION RELIABILITY	IBM Corporation 2070 Route 52 Dept. 18G, Bldg. 300-482 Hopewell Junction, N.Y. 12533

APPEAL BRIEF

Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

Sir:

On June 24, 2003, Appellant appealed to the Board of Patent Appeals and Interferences from the decision of the Primary Examiner finally rejecting claims 1 - 18. What follows is Appellant's Appeal Brief as required by 37 CFR 1.192(a).

REAL PARTY IN INTEREST:

International Business Machines Corporation, the assignee of the entire interest of the above-captioned application, is the real party in interest in this appeal.

RELATED APPEALS AND INTERFERENCES:

There are no related appeals and interferences involving the above-captioned application.

STATUS OF CLAIMS:

Claims 1 - 18 are the only claims pending in the above-captioned application and are the only claims appealed herein. There were no claims canceled during the pendency of the above-captioned application. A complete copy of the claims appealed can be found in the APPENDIX.

STATUS OF AMENDMENTS:

The posture of the claims involved in this appeal has not changed since Appellant's amendment filed January 6, 2003. There was no amendment filed since the Final Office Action mailed March 25, 2003.

SUMMARY OF THE INVENTION:

The present invention is related to providing mechanical reinforcement at the terminus of the anode end of a line portion of a semiconductor interconnect. The support is at the anode end only.

As can be seen in figure 2, the cross section of a line, 210, of interest is along the length of a line, not the width. As can be determined from figs 2 - 7a, generally, and figure 2 specifically is that the reinforcement that is the subject of the instant invention is present in the anode portion of the line only (specification page 12 lines 6 - 9). It is an important element of this invention that the reinforcement be placed only at the anode end of the line portion. Each of figures 2 - 7a show types of reinforcement structures contemplated. The structure shown in figure 4 is identified as a preferred embodiment.

ISSUES:

Whether claims 1-2, 4-5 and 11 have been properly rejected under 35 USC 103(a) as being unpatentable over USPN 6,232,662 to Saran, hereafter Saran in view of USPN 6,313,024 to Cave et al, hereafter Cave and whether claims 3, 6-10, and 12 - 18 have been properly rejected under 35 USC 103(a) as being unpatentable over Saran in view of Cave

further in view of US 2002/0132468 A1 (2468) to Wong et al, hereafter Wong.

GROUPING OF CLAIMS:

All of the claims do not stand or fall together. The claims have been grouped as follows and the patentability of the claims should be determined by examining a representative claim of each group.

Group 1: claims 1 - 16
Group II: claims 17 and 18

Arguments for the separate patentability of each claim group will be presented in the ARGUMENT section of this Appeal Brief.

ARGUMENT:

I. The first rejection:

Claims 1,2, 4,5 and 11 have been finally rejected by the Examiner under 35 USC §103(a) as being unpatentable over Saran in view of Wong. According to the Examiner in the Final Office Action, most of the elements of the instant invention as regard to claims 1,2,4,5 and 11 are presented in Saran.

II. The references:

Saran USPN 6,232,662 discloses a reinforcement structure for under a semiconductor bond pad (col. 7, lines 20 - 22). Figure 3 in Saran refers to a reinforcement structure where the circuit layout under the bond pad (30) includes metal interconnections (31, 32) under the bond pad in addition to the active elements (generally col. 8 lines 36 - 39). The interconnects are lined in a barrier underlayer (308) and disposed in a low dielectric constant material (307). Figure 4 refers to dummy metal structures (41, 42) disposed beneath the bond (40) for reinforcement (generally col. 8, lines 41 - 46). Neither of the metal structures shown in figures 3 and 4 extend beyond the bond pad region.

Cave et al USPN 6,313,024 (024) discloses non conductive support structures (52, 40, 28 in figure 8) that reinforce the areas under a bond pad that comprise a low k material. The conductive material in contact with the reinforcements are not electrically active interconnects (col. 3, lines 42 - 48).

III. The Appellant's Arguments:

Appellant's invention relates to a semiconductor interconnect that has a nonconductive reinforcement at the anode end only. The Final Office Action relies, alternately, to figures 3 and 4 in its positions that Saran teaches the subject matter of the instant invention. However, a careful reading of Saran shows that figures 3 and

4 are not interchangeable. In fact, the metal structures in figure 4 are not interconnects. The Final Office Action states that element 41 in figure 4 is the first reinforcement and that element 42 in figure 4 is a via portion but the element 32 in figure 3 is the line portion of the instant invention. The Appellants are not in agreement with this argument. First, if element 41 is a nonconductive reinforcement, the "interconnect" is not connected to the level below as there can be no metal to metal contact. Second, Saran shows a complete line/via structure in figure 3 (32/32b) and it would not be obvious to one skilled in the art to transpose a line portion only of an electrically active complete line/via structure in one figure (figure 3) into a non electrically active dummy metal structure in figure 4. Additionally, the Final Office Action transposes substrate layers between figures 3 and 4. The Final Office Action states that Saran shows "at least a part of the bottom side of the line portion of the first metal interconnect in contact with the first dielectric, Assuming arguendo, that the combination of the line portion of the interconnect taken from figure 3 and the via portion of the interconnect from figure 4 was correct, the bottom side of line portion is not in contact with the low k material in Saran (element 306, 309 in figure 3 and element 44 in figure 4). Lastly, the Final Office Action states that elements 43 and 44 identify the anode and cathode ends of the first metal interconnect. A careful reading of Saran shows that 43 and 44 identify layers of dielectric materials in which dummy metal structures are formed. They do not

relate to the electrical properties of a metal interconnect. Further, according to the Final Office Action, the cathode section of the metal interconnect corresponds to the non-conductive reinforcement and is not in contact with either the line or via portions of the first metal interconnect. None of the features of base claim 1 (and dependent claims 2, 4, 5 and 11 cannot be taught by Saran.

The Final Office Action relies on Cave to show that reinforcements can be non-conductive. A comparison of any of Appellant's claims 1, 2,4, 5 and 11 shows important differences between the instant claims and Cave alone, or in combination with Saran, the conductive elements in the instant invention are electrically active (claims 1,2, 4,5 and 11) and the conductive elements in Cave are not electrically active (col. 3, lines 42 - 48). In Cave, the metal elements are the supports or reinforcements (col. 3, lines 53 - 60). In the instant invention, the non conductive reinforcements are the supports. Additionally, the dielectric in Cave is a low k material (col.4, lines, 23 - 37) which would generally not be considered by one skilled in the art to be a good reinforcement material. Base claim 1 of the instant invention states that the material comprising the reinforcement should be mechanically more rigid than the first material that the interconnect is disposed in. Based on the substantial differences between the Appellants' claims 1,2, 4,5 and 11 and Saran, alone or in combination with Cave, the Office has not met its burden of establishing obviousness of Appellants' claims 1,2, 4, 5

and 11.

I. The second rejection:

Claims 3, 6 - 10 and 12 - 18 are rejected under 35 USC 103(a) as being obvious over Saran and Cave as applied to claim 1 above and further in view of Wong (US 2002/0132468 A1). According to the Final Office Action, Wong teaches multi levels of electrically active interconnects. The Final Office Action also states that Wong teaches "a first reinforcement in contact with the via portion in an anode section of the second metal interconnect 206 and the top of the line portion 104 of the first interconnect 106…."

II. The references:

In addition to Saran and Cave as described above, the Final Office Action relies on Wong (US 2002/0132468 A1), hereafter Wong. In figure 10 Wong discloses a metal interconnect (206) disposed in a low k material (112). The low k material is sheathed in a high dielectric constant material (110). Further the metal interconnect (206) is in electrical communication with a second metal interconnect (106). The second interconnect is disposed in an undetermined dielectric constant material (102), the dielectric constant preferably being less than that of silicon dioxide (page 3 paragraph 0039). Figure 12 outlines

the process steps when forming the structure according to claim 10.

III. The Appellant's Arguments:

The combination of Saran, Cave and Wong does not teach the subject matter of any of claims 1 - 16 generally and claims 3,6 - 10 and 13 - 16 specifically. It is an element of all of claims 6 - 10 and 13 - 16 that at least a part of the top side of the line portion of the second metal interconnect be in contact with the first material (see claim 6). The Final Office Action identifies 206 in figure 10 of Wong as the second metal interconnect. According to Wong, each layer is formed by first depositing a thick copper diffusion or etch stop layer (402 in figure 12) prior to forming a low k layer. Therefore the top of the second interconnect would not contact the first material (which is not the reinforcement material, see claims 1 and 6). It would not be obvious to one skilled in the art to combine Wong with Cave and Saran. Assuming, arguendo, that the references were combined the Office has not met its burden of establishing obviousness and thus Saran, Cave and Wong, alone or in any combination, cannot render obvious any of claims 3, 6 - 10 and 12 - 16.

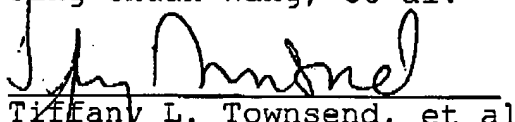
As to claims 17 and 18, Wong does not disclose that the reinforcing material 110 is in contact with bottom of the line portion of any of the second or subsequent interconnects. The formation of any second or subsequent

interconnect would follow the processing steps outlined in Wong (figure 12) and the reinforcement 110 would not be in contact with the bottom of the line portion 206 (see figure 10 of Wong) and that is an element of claims 17 and 18. With respect to claims 17 and 18, the Office has not met its burden of establishing obviousness and thus Saran, Cave and Wong, alone or in any combination, cannot render obvious any of claims 17 or 18.

Summary:

In summary, can it be said that Saran alone or with any combination of Cave and Wong renders obvious claims 1 - 16 or 17 and 18? The Appellant submits that the answer is no. Accordingly, in view of all of the preceding remarks, it is submitted that the Examiner's rejections of claims 1 - 18 were in error and reversal of his decisions is respectfully requested.

Respectfully submitted,
Ping-Chuan Wang, et al.

By: 

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Appendix showing the Claims in Marked up Format

1. A reinforced semiconductor interconnect structure, comprising:

A first metal interconnect disposed in a first material, the first metal interconnect having a line portion and at least one via portion, an anode section and a cathode section, the via portion of the first metal interconnect located in the anode section, the line portion of the first metal interconnect having a top, bottom and terminus side, wherein at least a part of the bottom side of the line portion of the first metal interconnect in contact with the first material;

a first reinforcement disposed in the first material, the first reinforcement in contact with the anode section of the bottom side of the first metal interconnect, the first reinforcement comprising a second material, the second material being electrically nonconductive; and wherein the second material has a greater mechanical rigidity than the first material.

2. The structure of claim 1 wherein the first material is a low dielectric constant material, having a dielectric constant of at most about 4.3.

3. The structure of claim 1 wherein the second material is a high dielectric constant material.

4. The structure of claim 1 wherein the line portion of the first metal interconnect is in contact with the reinforcement.

5. The structure of claim 1 wherein the first reinforcement is in contact with the via portion of the first interconnect.

6. The structure of claim 1 further comprising a second metal interconnect disposed in a fifth material, the metal interconnect having a line portion and a via portion, the line portion having a top and bottom side, wherein at least a part of the top side of the line portion of the second metal interconnect is in contact with the first material and wherein the via portion of the first metal interconnect is in electrical contact with the second metal interconnect.

7. The structure of claim 6 further comprising a second reinforcement disposed in a third material, the second reinforcement in contact with the first metal interconnect and wherein the second reinforcement comprises a fourth material.

8. The structure of claim 7 further comprising a third metal interconnect disposed in the third material, the third metal interconnect having a line portion and at least one via portion, the third material deposited on at least the line and via portions of the first metal interconnect, the third metal interconnect in electrical contact with the first metal interconnect and wherein the second

reinforcement is in contact with the third metal interconnect.

9. The structure of claim 7 wherein the second reinforcement is in contact with the via portion of the anode section of the first metal interconnect.

10. The structure of claim 8 wherein the second reinforcement is in contact with the third metal interconnect.

11. The structure of claim 1 wherein the first reinforcement is in contact with the via portion in the anode section of the first metal interconnect and the length of first reinforcement is at most 50% of the length of the first metal interconnect.

12. The structure of claim 10 wherein the first reinforcement is in contact with the via portion in the anode section of the first metal interconnect and the length of the first reinforcement is at most 50% of the length of the first metal interconnect and wherein the length of the second reinforcement is at most 50% of the length of the first metal interconnect.

13. The structure of claim 7 wherein the second and fourth materials are substantially the same.

14. The structure of claim 7 wherein the first third, and fifth materials are substantially the same.

15. The structure of claim 7 wherein the first, third and fifth materials are selected from the group consisting of polyimide, parylene, polytetraflouroethylene, SiLK™ and Cyclotene™, Black Diamond™, silicon-containing organic dielectric materials such as benzocyclobutene, hydrogen/alkane-SQ family material such as HSQ or MSQ (methyl sesquisiloxanes), nano-pore containing materials, and air gaps.

16. The structure of claim 7 wherein the second and fourth materials are selected from the group consisting of silicon dioxide, fluoro-silicate glass, silicon nitride, silicon oxynitride (SiO_xN_y) and diamondlike carbon.

17. A reinforced interconnect structure, comprising:

First, second and third metal interconnects, each of the first, second and third interconnects disposed in a mechanically compliant dielectric, each of the first, second and third interconnects have a line portion and a via portion, each of the line portions of the first, second and third interconnects having a top and a bottom, each of the first, second and third interconnects having an anode section and a cathode section, wherein the via portion of the second metal interconnect is in electrical communication with the line portion of the first metal interconnection and wherein the third interconnect is in electrical communication with the second interconnect;

first and second reinforcements, each of the first and second reinforcements comprising a mechanically rigid material, the first reinforcement in contact with the via portion in the anode section of the second metal

interconnect and the top of the line portion of the first interconnect, the second reinforcement in contact with the top of the line portion in the anode section of the second interconnect and the bottom of the line portion of third interconnect.

18. A reinforced interconnect structure, comprising:

First, second and third metal interconnects, each of the first, second and third interconnects disposed in a mechanically compliant dielectric, each of the first, second and third interconnects have a line portion and a via portion, each of the line portions of the first, second and third interconnects having a top and a bottom, each of the first, second and third interconnects having an anode section and a cathode section, wherein the via portion of the second metal interconnect is in electrical communication with the line portion of the first metal interconnection and wherein the third interconnect is in electrical communication with the second interconnect;

first and second reinforcements, each of the first and second reinforcements comprising a mechanically rigid material, the first reinforcement positioned in the dielectric between the first and second interconnects and the second reinforcement positioned in the dielectric between the second and the third interconnects.

TRANSMITTAL OF APPEAL BRIEF (Large Entity)	Docket No. FIS920010311US1

In Re Application Of: **Ping-Chuan Wang et al.**

Serial No.	Filing Date	Examiner	Group Art Unit
10/026,117	12/21/2001	Ida M. Soward	2822

Invention:

LOW DIELECTRIC CONSTANT MATERIAL REINFORCEMENT FOR IMPROVED ELECTROMIGRATION RELIABILITY

TO THE COMMISSIONER FOR PATENTS:

Transmitted herewith in triplicate is the Appeal Brief in this application, with respect to the Notice of Appeal filed on

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Signature

Dated: **August 19, 2003**

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I certify that this document and fee is being deposited on August 19, 2003 addressed to the Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Colleen J. Dew

Signature of Person Faxing Correspondence

Colleen J. Dew

Typed or Printed Name of Person Faxing Correspondence

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Re Applic of	Ping-Chuan Wang et al.	
Docket No.	FIS920010311US1	
Serial No.	10/026,117	
Filing Date	12/21/2001	
Attorney	Tiffany L. Townsend	

Attached: Final Office Action - Appeal Brief

PLEASE DELIVER TO:

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